

I claim:

1. A method for connecting a joint of pipe to a top drive assembly located in a drilling mast of a drilling rig, the method comprising the steps of:

- (a) raising or lowering the top drive assembly in the drilling mast to a first predetermined position above a drilling platform on the drilling rig, the top drive assembly having a top drive motor with a rotatable quill, said first predetermined position suitable for the top drive assembly to connect with a joint of pipe, the joint of pipe having a box end and a pin end defining a longitudinal axis between said ends;
- (b) moving a joint of pipe to a second predetermined position adjacent to the drilling platform suitable for connecting the joint of pipe to the top drive assembly, the joint of pipe having the box end pointed toward the top drive assembly;
- (c) tilting the top drive motor about a substantially horizontal axis until the quill is pointed toward the box end of said pipe and substantially aligned coaxially with the longitudinal axis of said pipe;
- (d) pushing the joint of pipe along its longitudinal axis from the second predetermined position toward the top drive motor whereby the box end of the pipe may be threadably engaged to the quill; and
- (e) gripping and pulling the joint of pipe along its longitudinal axis toward the top drive motor while simultaneously rotating the quill to threadably engage the box end of the pipe until the connection between the joint of pipe and the top drive assembly is substantially complete.

2. The method as set forth in claim 1 further comprising the steps of:

(a) raising the top drive assembly in the drilling mast while the top drive motor simultaneously rotates back to a nearly vertical orientation thereby pulling the joint of pipe up into the drilling mast until the pin end is clear of the drilling platform; and

(b) continuing to rotate the top drive motor to its vertical orientation thereby placing the pin end of the pipe above the drilling platform.

3. The method as set forth in claim 1 further comprising the step of connecting the pin end of the pipe to a drill string or to a drill bit for drilling a well.

4. A system for connecting a joint of pipe to a top drive assembly located in a drilling mast of a drilling rig, the drilling mast defining a substantially vertical drilling axis, the system comprising:

a top drive assembly having a top drive motor with a quill capable of rotation about an axis that is substantially coaxially aligned with the drilling axis when the top drive motor is being operated in drilling operations;

means for raising or lowering the top drive assembly in the drilling mast to a first predetermined position above a drilling platform on the drilling rig, said first predetermined position suitable for the top drive assembly to connect with a joint of pipe, the joint of pipe having a box end and a pin end defining a longitudinal axis between said ends;

means for moving the joint of pipe to a second predetermined position adjacent to the drilling platform suitable for connecting the joint of pipe to the top drive assembly, the joint of pipe having the box end pointed toward the top drive assembly;

means for tilting the top drive motor about a substantially horizontal axis until the quill is pointed toward the box end of said pipe and substantially aligned coaxially with the longitudinal axis of said pipe;

means for pushing the joint of pipe along its longitudinal axis from the second predetermined position toward the top drive motor whereby the box end may be threadably engaged to the quill; and

means for grasping and pulling the joint of pipe along its longitudinal axis toward the top drive motor.

5. The system as set forth in claim 4 wherein the top drive assembly comprises a top drive frame adapted for being raised and lowered in a drilling mast of the drilling rig, the top drive motor pivotally attached to the top drive frame whereby the top drive motor is capable of tilting about a substantially horizontal axis.

6. The system as set forth in claim 4 wherein the means for raising and lowering the top drive assembly to the first predetermined position comprises a draw works mechanism.

7. The system as set forth in claim 4 wherein the means for moving the joint of pipe to the second predetermined position comprises a pipe launcher having a ramp, the pipe launcher adapted to raise the joint of pipe from a pipe loading position where the pipe is loaded onto the ramp of the pipe launcher whereby the pipe is raised and tilted to the second predetermined position, the pipe pointed toward the drilling platform, the box end higher in elevation than the pin end.

8. The system as set forth in claim 4 wherein the means for tilting the top drive motor about the horizontal axis comprises at least one hydraulic cylinder having first and second ends, the first end operatively connected to the top drive frame, the second end operatively connected to the top drive motor, whereby operation of the hydraulic cylinder thereby results in the top drive motor rotating about the horizontal axis with respect to the top drive frame.

9. The system as set forth in claim 4 wherein the means for pushing the joint of pipe comprises a buggy adapted to travel along the ramp of the pipe launcher, the buggy adapted to support the pin end of the pipe as the buggy pushes the joint of pipe.

10. The system as set forth in claim 4 wherein the means for grasping and pulling the joint of pipe is a pipe clamping assembly comprising:

a sliding member having first and second ends, the first end slidably attached to the top drive motor, the sliding member capable of sliding along an axis

substantially parallel to the longitudinal axis of the quill; and

a pipe clamp subassembly operatively attached to the second end of the sliding member, the pipe clamp subassembly adapted to grasp the pipe after the sliding member has extended downward from the top drive motor until the pipe clamp subassembly is positioned below the quill, the pipe clamp subassembly adapted to clamp the joint of pipe and align it with the longitudinal axis of the quill, the sliding member further capable of retracting toward the top drive motor after the pipe clamp subassembly has clamped the pipe to thereby pull the clamped pipe toward the top drive motor for connection with the quill.

11. A top drive assembly for use in a drilling rig, comprising:

a top drive frame adapted for being raised and lowered in a drilling mast of the drilling rig, the drilling mast defining a substantially vertical drilling axis;

a top drive motor having a quill adapted for connection with a joint of pipe, the quill capable of rotation about a longitudinal axis that is substantially coaxially aligned with the drilling axis when the top drive motor is being operated in drilling operations, the top drive motor being pivotally attached to the top drive frame whereby the top drive motor is capable of tilting about a substantially horizontal axis;

means for tilting the top drive motor about the horizontal axis with respect to the top drive frame thereby tilting the longitudinal axis of the quill from the substantially vertical drilling axis; and

means for gripping a joint of pipe, said gripping means operatively attached to the top drive motor, said gripping means capable of grasping a joint of pipe positioned beneath the top drive motor and pulling the joint of pipe toward the top drive motor for connection with the quill.

12. The top drive assembly as set forth in claim 11 wherein the top drive frame is adapted to be raised and lowered in the drilling mast by a draw works mechanism.

13. The top drive assembly as set forth in claim 11 wherein the quill further comprises pin threads for connection with a box end of the joint of pipe.

14. The top drive assembly as set forth in claim 11 wherein the means for tilting the top drive motor about the horizontal axis comprises at least one hydraulic cylinder having first and second ends, the first end operatively connected to the top drive frame, the second end operatively connected to the top drive motor, whereby operation of the hydraulic cylinder thereby results in the top drive motor rotating about the horizontal axis with respect to the top drive frame.

15. The top drive assembly as set forth in claim 11 wherein the means for grasping a joint of pipe is a pipe clamping assembly comprising:

a sliding member having first and second ends, the first end slidably attached to the top drive motor, the sliding member capable of sliding along an axis substantially parallel to the longitudinal axis of the quill; and

a pipe clamp subassembly operatively attached to the second end of the sliding member, the pipe clamp subassembly adapted to grasp the pipe after the sliding member has extended downward from the top drive motor until the pipe clamp subassembly is positioned below the quill, the pipe clamp subassembly adapted to clamp the joint of pipe and align it with the longitudinal axis of the quill, the sliding member further capable of retracting toward the top drive motor after the pipe clamp subassembly has clamped the pipe to thereby pull the clamped pipe toward the top drive motor for connection with the quill.

16. The top drive assembly as set forth in claim 15 wherein the pipe clamp assembly comprises:

a pipe clamp frame;

a pipe clamp; and

a pipe clamp actuator operatively connecting the pipe clamp to the pipe clamp frame, the pipe clamp actuator adapted to move the pipe clamp in clamping engagement against a joint of pipe.